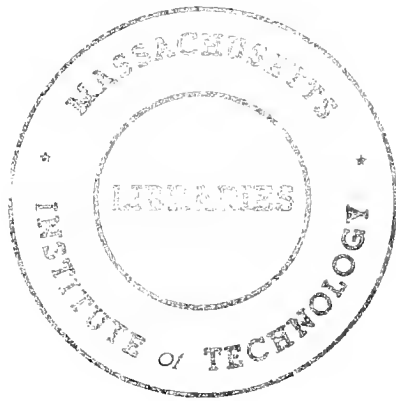


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Inflation and Environmental Concern: Structural Change
in the Process of Public Utility Price Regulation*

Paul L. Joskow

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The views expressed herein are the author's sole responsibility and do not reflect those of the Department of Economics or of the Massachusetts Institute of Technology.

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INFLATION AND ENVIRONMENTAL CONCERN: STRUCTURAL CHANGE
IN THE PROCESS OF PUBLIC UTILITY PRICE REGULATION

Paul L. Joskow

The last ten years have witnessed a tremendous renewal in academic interest regarding the causes and effects of government regulation of the economy. Traditional concerns about the effects of public utility price regulation via state and federal regulatory commissions have been augmented by more general interest in governmental efforts to intervene in market processes through the use of price regulation, quality control, safety standards, environmental restrictions, etc.

In the analysis of government regulation, it is possible to discern four major academic "problem" areas that have received attention. First, there has been the question of why we get government regulation in a particular market. This question has gotten some attention from political scientists and historians, but has recently attracted the interest of a number of economists.¹ The work in this area is still developing, and

¹See Stigler [24], Posner [21] and Jordan [11].

prevailing theoretical and conceptual models leave much to be desired. The second set of important questions revolves around the choice of regulatory instruments, once a regulatory authority has been set up. Most statutes defining regulatory jurisdiction are fairly vague and it is usually left up to the agency itself to define the set of regulatory "techniques"

that will be employed. Research seeking to understand exactly what policy instruments are used by regulatory agencies, and what the interrelationship is between the regulated and regulators is fairly sparse.²

²See Breyer and MacAvoy [7] which is an exception.

Perhaps the greatest amount of research by economists has been directed toward a third set of questions. Given the existence of government regulation, and a well defined set of regulatory procedures, what are the effects on the allocation of resources implied by these procedures? A substantial amount of purely analytic work has been dedicated to the analysis of the effects of rate of return type regulation on the behavior of regulated firms--the "Averch-Johnson" model.³ In addition, a large number of industry specific

³Averch and Johnson [2] and Baumol and Klevorick [6].

studies have attempted to isolate the relevant regulatory instruments and quantify their effects.⁴ These studies have usually made use of fairly

⁴See for example Peltzman [20].

conventional comparative statics models and available empirical evidence to compare the "regulated" world with an ideal competitive world. This work often suffers because of an incomplete development of the actual process of regulation that is being evaluated, comparisons with competitive ideals which are not actually feasible alternatives, and a failure to deal with the distributional consequences of regulation in a satisfactory fashion.

A fourth line of inquiry deals with changes in regulatory processes.. Why

do regulatory instruments change and how are new techniques diffused among the different regulatory jurisdictions? This final area has also attracted only scattered attention from economists, but similar issues have been of some recent concern to sociologists and political scientists.⁵

⁵See Gray [10], Mohr [18] and Walker [25].

It is the second and fourth areas of inquiry that I propose to tackle in this paper, in the context of the most traditional type of government regulation--state rate of return regulation of public utilities. I believe that the proper definition of regulatory instruments, how they are used and how they change, is basic to any analysis of the effects of regulation on static and dynamic aspects of resource allocation. I argue here that the impetus for change in regulatory techniques comes from pressures put on existing regulatory institutions by changes in the economic and political environment in which the regulatory process functions. The susceptibility of an existing set of regulatory institutions depends critically on the structure of the regulatory mechanism that links the regulated firms with the regulatory agency. By constructing a structural model of existing regulatory interactions, the effects of changes in the economy and other legal institutions within which regulation must operate may be predicted. While a formal mathematical model is not attempted, the "way of looking at things" presented yields a set of testable hypotheses and is itself useful for asking various comparative statics questions and for predicting the direction of changes in regulatory procedures.

The paper proceeds by first reviewing the results of the "Averch-Johnson" literature since this appears to be the prevailing model of public

utility type price regulation in the United States. I argue that this model does not capture the essence of the regulatory process and as a result may lead to incorrect predictions of static and dynamic efficiency. More importantly it is useless for predicting changes in regulatory techniques and their associated effects. An alternative conceptual model of regulation is then presented along with a set of propositions concerning the behavior of firms and regulators. Available empirical evidence is then examined. This evidence is found to be consistent with the conceptual model hypothesized here, but generally inconsistent with the characterization of regulation implied by A-J models. The conceptual model is then used to predict changes in regulatory techniques that are expected to occur when changes take place in the economic and political environment in which public utility regulation operates. The final section discusses the nature of new regulatory instruments being adopted to alleviate pressures put on the regulatory process and how they are diffused among the different states.

Regulation in the World of Averch and Johnson

The past ten years have seen the evolution of a lengthy theoretical literature dealing with "the behavior of the firm under regulatory constraint." The original work of Averch and Johnson has been extended and corrected by a number of authors. In addition, the "results" of A-J type models are routinely cited as justification for a broad array of public policy prescriptions in both academic and non-academic circles. There is no question that the A-J type model has for many researchers become an accepted paradigm for the analysis of the effects of "rate of return" regulation of public utilities in the United States. More specifically the A-J model has evolved from a theoretical construct useful for asking questions

on the order "how is the behavior of a neoclassical firm affected by a regulatory constraint of a particular type?" to an accepted descriptive model which implicitly assumes that actual regulatory processes are characterized in this way. Clearly, the usefulness of this model for actual policy evaluation depends critically on whether the model captures the essence of actual regulatory processes that are being evaluated. If the model does not provide a reasonable abstraction of actual regulatory instruments, its usefulness for evaluating such instruments is doubtful. It is argued in the next section that the characterization of regulation implicit in A-J models bears little correspondence with actual regulatory instruments. As a result, these models may be of little use in evaluating the effects of actual regulatory instruments on the behavior of regulated firms. The evaluation of the effects of regulatory instruments can reasonably be accomplished only if we have a proper characterization of exactly what the instruments are and how they are used.

A-J models specify a monopoly firm producing output with a neoclassical production function employing two resource inputs - capital and labor. The firm is assumed to have some objective function - usually profits - that it tries to maximize. The regulatory commission comes into the picture as a constraint on the firm's behavior. It is normally assumed that the firm is constrained to earn some "fair" rate of return on its capital stock, greater than the cost of capital, but less than the unconstrained profit maximizing rate of return. Implicitly, the objective of the regulatory commission is viewed to be the constraining of earned rates of return to the allowed rate of return. The problem then becomes a constrained profit (in the standard case) maximization problem with the binding constraint being the allowed rate of return on capital. The primary result of the

basic model is that such a constrained firm will produce output at other than minimum cost. In particular, the expansion path of the constrained firm implies a capital labor ratio that is higher than a cost minimizing producer would use - the often referred to A-J capital bias. Extensions of this basic model have included the examination of different firm objective functions as well as different types of regulatory constraints.⁶

⁶See Bailey and Malone [5].

Not surprisingly changing the nature of the objective function and the nature of the constraints alters the basic conclusion. Since a firm can never do better than minimize cost, changing the model around either changes the size or direction of the production inefficiency or returns the firm to the cost minimizing expansion path. As a result, most work continues to make the classical assumptions of profit maximization and a binding rate of return constraint.

Some richness has been added to this model by freeing the regulatory commission from constant regulatory review. A number of attempts to introduce "regulatory lag" into the model have been made. These models normally give an active (deterministic or probabilistic) role to the regulatory agency. During the "lag" period the firm is allowed certain behavior (depending on the particular model) but there is always the regulatory commission sitting out there ready to pounce on the firm, forcing its earned rate of return back to the allowed rate of return. Such pouncing may occur at set intervals or probabilistically according to some known (by the firm)

probability distribution.⁷

⁷ Bailey and Coleman [4] and Klevorick [17]. Note especially that the Bailey and Coleman model has the period between regulatory reviews as one in which the firm sacrifices profits which are to be recouped later when a regulatory review takes place. In the discussion presented below, just the opposite occurs, with the period between regulatory reviews corresponds to higher profits for the firm than it achieves at the time of review. The discussion below is predicated on a fundamentally different notion of the nature of this "inter-review" period.

The welfare implications of rate of return regulation have been examined in the "optimal fair rate of return literature."⁸ In these models,

⁸ See Klevorick [16] and Sheshinski [22].

the optimal rate of return is derived by replacing the firm profit maximizing objective with some social welfare maximizing objective. The idea is then to pick that allowed rate of return which yields a constrained (by the rate of return constraint) welfare maximum. Bailey indicates that "some regulation" will always be optimal.⁹ This strain of the literature

⁹ Bailey [3] as amended.

is important because it recognizes that cost minimization cannot be the only criterion for judging a regulatory system. If it were we would simply be satisfied with no regulation since a neoclassical monopoly firm uses its resource inputs efficiently.

In short, the results of the A-J type model are generated by specifying an active regulatory agency which continually or intermittently forces the regulated firm to adjust its price so that (at most) the allowed rate of return is achieved. The actual objectives of the regulatory agency are

not specified, but rather appear as reduced form behavioral relationships yielding a particular level of the allowed rate of return and particular timing patterns for the enforcement of the regulatory constraint. Based on these behavioral relationships the firm then attempts to maximize its (long run) profits.

My concern here is not with whether firms maximize profits or something else. I am also not concerned with how long the period of "regulatory lag" actually may be nor with what the allowed rate of return is or should be (optimally?). Rather, I am concerned with the basic structure of the process of regulation implied in the A-J literature.

Public Utility Regulation in the Real World

The regulatory process includes two primary actors as well as a set of potential actors. The primary actors in the regulatory process are the firm and the regulatory agency. The potential actors are "consumers" or interest groups which may enter as intervenors into the formal regulatory process or put pressure on the regulatory commission outside of the formal hearing process.

The regulatory process is conveniently broken down into the formal regulatory process and the informal regulatory process. The formal regulatory process involves the formal rate of return hearings where an allowed rate of return is determined and a set of prices fixed accordingly. Prices remain at this level unless a change is approved by the regulatory authority. The informal regulatory process consists of the interactions between the firms and regulators that go on outside of the formal hearing process.¹⁰

¹⁰ In the context of this discussion a comment on "regulatory-lag" is in order. The period between regulatory reviews has often been referred to

(pejoratively) as a period of regulatory lag during which the regulatory agency is in some sense waiting around to "constrain" the firm's rate of return. In reality the commission is trying to do no such thing. It seeks to maintain this informal regulatory arrangement as long as the firm does not seek a price increase. "Regulatory lag" does occur once firms decide to file for a price increase. It normally take from 12-18 months in most states from the time a firm files for a price increase until the time that new rates actually go into effect. I will refer to this period of time as processing lag.

In terms of the objectives of the firms being regulated there is little question about the fact that they "like" profits. We might think of them as strict profit maximizers or I believe more realistically, as having targets for a set of financial variables that are indicators of the overall financial well being of the firm.¹¹ Given any set of regula-

¹¹ See Joskow [12].

tory institutions the long run behavior of firms will be consistent with profit maximization, while short run behavior will depend more on a specification of short run decision rules.

The objectives of regulatory commissions are naturally less clear and probably more complex than those of the regulated firms. The statutes establishing most regulatory agencies are usually quite vague. Regulatory agencies are normally mandated to insure that rates charged by regulated firms are "reasonable and non-discriminatory" and that service of "good quality" is maintained. Legislatures rarely specify the regulatory instruments and procedures that administrative agencies must follow, but rather leave it up to the administrative agencies themselves to determine what instruments to use and how they should be applied. The statutes give the regulatory authorities a great deal of freedom for choosing how the

vague statutory mandates should be implemented; however, commissions are constrained to adhere to various due process requirements inherent in common law and statutory law requirements for the acceptability and even necessity of various types of administrative procedures. The Hope decision, often cited in the first footnote of A-J type models (I wonder how many of these authors have actually read the opinion) essentially implies that the law does not require any particular set of instruments for arriving at public utility prices, but requires only that any procedures used respect certain norms of fairness, in particular that rates be high enough to allow a regulated firm to earn a "fair" return for its stockholders so that it can continue to exist and obtain capital through standard capital markets.¹²

¹²FPC v. Hope Natural Gas Co. 320 U.S. 591 (1944). The case applied specifically to the activities of the Federal Power Commission, but has generally been applied as a precedent for all public utility type regulation. In its decision, the court refused to require the FPC to use a specific formula for establishing public utility rates.

"Under the statutory standard of 'just and reasonable' it is the result reached, not the method employed which is controlling"

"Rates which enable the company to operate successfully, to maintain its financial integrity, to attract capital, and to compensate its investors for the risks assumed...."

Regulatory agencies therefore operate within an environment which gives them a certain amount of flexibility in procedure. Statutes and court decisions limit the kinds of things that regulatory commissions can do, but no reasonable interpretations of statutes, court decisions, etc. could lead to the implication that the objective of public utility commissions should be to constrain a firm to some particular rate of return. One "test" which a commission must pass in making a rate determination is

that it has made a reasonable attempt to insure that the results of its actions are not confiscatory or unfairly burden any of the parties to the proceeding. In short, to the extent that the statutes and courts require public utility commissions to look at the rate of return, it is far more a lower bound requirement (at least enough to attract capital), than it is an upper bound requirement, and is only one of the many legal and institutional constraints which define the operating set within which regulatory commissions can function.

Given this fairly large amount of flexibility, the general view taken here is that regulatory agencies seek to minimize conflict and criticism appearing as "signals" from the economic and social environment in which they operate, subject to binding legal and procedural constraints imposed by the legislature and the courts. The agencies' organizational structure, regulatory instruments, and operating procedures are chosen so as to achieve this goal.

Given this "organizational" view of regulatory agencies, we might expect to observe such agencies in two different "modes" of operation. In the first mode, we might observe a regulatory agency that is in some kind of equilibrium relationship with the environment in which it operates. Equilibrium is characterized by a well established organizational structure and regulatory procedures and instruments that are well defined and used repetitively and predictably. The regulatory agency has evolved a structure which satisfactorily balances the conflicting pressures from the external environment. The second mode of operation of the regulatory agency might be called the "innovation mode." When we observe an administrative agency in this mode we are observing it in the process of evolution. It is searching for new procedures, regulatory instruments, etc. that will allow it to achieve or restore a satisfactory balance between the conflicting pressures

of its environment. This view requires us to ask three types of questions about state regulatory agencies.

(1) What are the procedures and instruments employed by regulatory agencies during a particular period of organizational equilibrium and how do these affect the behavior of regulated firms?

(2) What kinds of things disturb this organizational equilibrium and lead the regulatory agency to search for new methods of operation?

(3) How does search proceed and what will the new organizational equilibrium look like?

These questions are taken up in turn here in the context of state regulation of public utilities in the United States since WW II. I will concentrate on the equilibrium mode first, and characterize the nature of state public utility regulation in the U.S. during the 1950's and most of the 1960's.

Contrary to the popular view, it does not appear that regulatory agencies have been concerned with regulating rates of return per se. The primary concern of regulatory commissions has been to keep nominal prices from increasing. Firms which can increase their earned rates of return without raising prices or by lowering prices (depending on changing cost and demand characteristics) have been permitted to earn virtually any rate of return that they can. Formal regulatory action in the form of rate of return review is primarily triggered by firms attempting to raise the level of their rates or to make major changes in the structure of their rates. The rate of return review is then used to establish a new set of ceiling prices which the firm must live with until another regulatory hearing is triggered. General price reductions do not trigger regulatory review, but are routinely approved without formal rate of return review.

This regulatory process is therefore extremely passive. Regulators take no action regarding prices unless major increases or structural changes are initiated by the firms under its jurisdiction. In short, it is the firms themselves which trigger a regulatory rate of return review. There is no "allowed" rate of return that regulatory commissions are continually monitoring and at some specified point enforcing.¹³

¹³ I am constantly receiving requests for a list of "allowed rates of return" for the different states by graduate students trying to come up with empirical tests of the A-J propositions. They are dismayed to find out that such data do not exist.

This behavior follows from the generally passive nature of an organization in satisfactory equilibrium with its environment. State commissions especially are oriented to "do nothing" if none of the actors in the regulatory process are complaining. Consumer groups and their representatives (including politicians) tend to be content if the nominal prices they are charged for service are constant or falling. Consumers see prices not the rates of return earned by the producers. Especially in an economy where the average price level rises over time, consumers will be content with prices for a particular service that are constant or falling. Most regulatory commissions are aware of this and behave accordingly, leaving well enough alone as long as prices behave in this way. Regulatory reviews are therefore initiated by requests for nominal price increases and not by the drift of rates of return above some imaginary "allowed" level.

This behavior leads to the following propositions regarding the behavior of the regulatory agency and the firm.

Proposition 1: During periods of falling average cost we expect to observe virtually no regulatory rate of return reviews.¹⁴

¹⁴The references to "falling" and "rising" average costs need some clarification. Economists are used to talking about static cost functions where production costs are related to output produced with input prices and technology fixed - real costs. The costs discussed here are nominal costs over time and embody changes in input costs, output levels and technology that occur over time. It is nominal costs and nominal prices that are observable from period to period and that regulators observe and act on. Nominal costs will fall over time if there are economies of scale, no change in input prices and growing demand. Nominal costs may rise or fall over time if there are economies of scale, rising input prices and growing demand depending upon whether the exploitation of scale economies can overcome rising input prices.

Proposition 2: During periods of falling average costs we expect to observe constant or falling prices charged by regulated firms. Price reductions are not forced on the firms but rather are chosen so as to increase profits.

Proposition 3: During periods of falling average costs we expect to observe rising or constant (profit max) rates of return.

Propositions 1-3 follow directly from the passive behavior of the regulatory agency. Given a particular static demand function (assume that the overall price level in the economy is constant) a decline in the nominal average cost of producing output by the regulated firm will lead to increased total profits at the prevailing price (and output) level. Profits may be increased even further by the firm lowering its prices if marginal revenue rises above marginal cost at the prevailing level of prices.¹⁵ No

¹⁵Appropriate shifts in the cost function resulting from technological change, coupled with growing demand may yield profit maximizing price below the original ceiling price.

regulatory review is triggered and the firms can happily increase their rates of return with constant or falling prices.

Most state regulatory agencies are responsible for several firms within a particular regulated industry, and there is no reason to believe that all firms face qualitatively identical cost conditions and demand characteristics. As a result, within a particular state we might very well observe some firms engaged in virtually continuous rate of return review as rate relief is sought to compensate for rising costs of production, while other firms faced with declining production costs are never before the regulatory agency for a rate of return review because they can earn a higher rate of return at prevailing prices than would be deemed "fair" in a formal regulatory proceeding.

Proposition 4: Rates of return of firms not engaged in the formal hearing process will be higher than the rates of return of firms trying to get their prices raised via formal regulatory review.

Proposition 4 follows from a somewhat more complicated argument. Firms which do find themselves forced to raise their prices, do so with full knowledge that they will be entering a radically different regulatory environment. By requesting a price increase they are in effect forcing the regulatory commission to act. The production costs and earned rate of return are scrutinized by the regulatory agency to a far greater extent than when firms are not engaged in formal hearings. A "fair" rate of return is determined by the commission based on the testimony of conflicting parties and its own historical judgment.¹⁶ This "fair" rate of return

¹⁶See Joskow [12].

will tend to be much closer to the cost of capital than the rates of return that might be earned without formal regulation. One plausible explanation

for this is that the earned rates of return of firms outside the formal review process are used by the commission to form some notion of what the upper bound on the allowed rate of return should be. In short, we might specify a real rate of return s that a firm may expect to achieve if it enters the formal hearing process. The value s can be used to calculate the prospective value of more meaningful variables like earnings per share, interest coverage, etc. used by firms in making pricing decisions.

Over time we might expect firms in a particular regulated industry to experience periods of falling average production cost, rising average production costs and constant average production costs. The nature of the process of regulation described here indicates that observed regulatory activity and the profitability of regulated firms will differ among the different cost situations.

Proposition 5: The transition from a period of falling average costs to one of rising average costs for a particular regulated industry will at first yield no observable increase in the number of rate of return reviews filed by the regulatory agency, but as cost increases continue more and more rate of return reviews are triggered as firms seek price increases to keep their earned rates of return at least at the level that they expect the commission will allow in a formal regulatory hearing.

Proposition 6: The transition from a period of generally falling average costs to one of rising average costs for the firms in a particular regulated industry leads at first to a decline in nominal and real rates of return as cost increases are absorbed and then to stability in real rates of return as the "allowed" rate of return becomes the earned rate of return for all firms which are now engaged in the formal hearing process.

Propositions 5 and 6 follow directly from proposition 4. During

periods of falling average costs firms can achieve rates of return $r^* > s$ either by leaving their prices where they are or lowering them. As the nominal cost situation changes, the firms find themselves in a position where $r^* > s$, are faced with a set of output prices that cannot be increased without triggering a regulatory hearing, and most importantly, average production costs are increasing. As a result, r^* begins to decline toward s . Until $r^* = s$, however, the firm will not seek a price increase since it will not be granted. When r^* finally falls to s , the firm will seek a price increase to maintain its rate of return at s and will continually return for price increases as nominal average costs continue to rise. If this kind of cost behavior is characteristic of many firms under the jurisdiction of a particular regulatory agency, the transition from a period of generally falling average costs to one of rising average costs coincides with a movement from a period of little formal regulation to one in which all firms are subject to virgually continual formal regulatory review (see below).

We can therefore observe firms in three different modes of operation. They may be operating with a price equal to that allowed in the last regulatory review ($P_o = P_r$) and earning profits greater than or equal to what would be allowed in a regulatory review. Second, they may be operating at a price less than what was set in the last regulatory review ($P_o < P_r$) and would be earning profits greater than or equal to what would be allowed in a regulatory review (actually if costs have been decreasing over time $P_o < P_r$ implies that $MR=MC$ and profits would always be greater than what was allowed. However, costs may first fall and then rise, in which case profits could decline back toward the regulated level, since once prices have been reduced, they cannot be raised again without a formal review). Finally, the firm might return to the regulatory agency to have its prices

($P_0 > P_r$) and would be earning profits equal to those allowed during regulatory review. Exactly what mode the firm is operating in depends upon the behavior of its nominal costs over time.

For example, assume that the firm's average cost is a function of the prevailing wage rate only.

$$(1) \quad AC = AC(w)$$

and that the firm faces an isoelastic demand function

$$(2) \quad Q = P^{-\epsilon}$$

Given the prevailing wage rate the maximum profit is given by the following:

$$(3) \quad \pi = \frac{1}{\epsilon} \left[\frac{AC}{1-1/\epsilon} \right]^{1-\epsilon}$$

For simplicity we may write the regulatory constraint as some maximum markup over incurred production costs

$$(4) \quad P \leq (1+\alpha)AC$$

where α is the allowed mark-up used during regulatory review. The mark-up allowed by the regulatory authority is assumed to be less than the "profit-maximizing mark-up"

$$(5) \quad \alpha \leq \frac{1}{\epsilon-1}$$

Assume that P_0 is the prevailing price level and that w_2 is the wage rate that raises production costs to a level high enough to trigger a regulatory review given the prevailing price level. w_1 is the wage rate at which marginal revenue is equal to marginal cost given P_0 and the associated output level ($w_1 < w_2$). Then the three modes of operation discussed above can be characterized in the following way:

$$(6) \quad P \leq P_0$$

$$0 \leq w \leq w_1, \text{ where } AC(w_1) = (1-1/\epsilon)P_0$$

$$\pi = \frac{1}{\epsilon} \left[\frac{AC}{1-1/\epsilon} \right]^{1-\epsilon} \quad (MR=MC)$$

$$(7) \quad P = P_0$$

$$w_1 < w < w_2, \text{ where } AC(w_2) = P_0/(1+\alpha)$$

$$\pi = (P_0 - AC(w))Q_0$$

$$(8) \quad P > P_0$$

$$w_2 < w$$

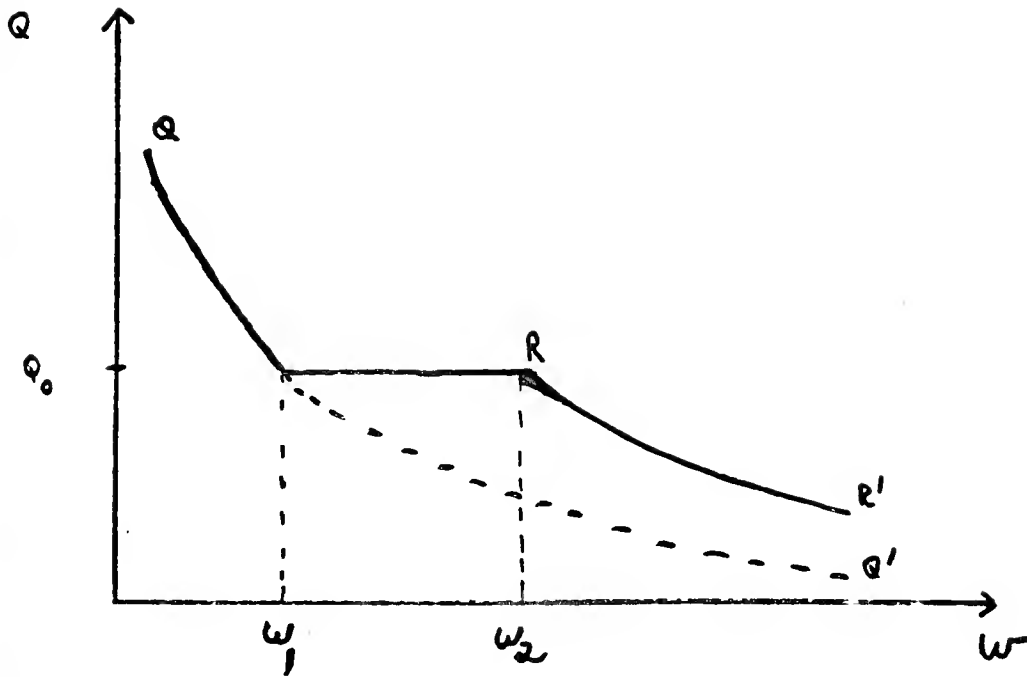
$$\pi = \frac{\alpha}{1+\alpha} \left[(1+\alpha)AC \right]^{1-\epsilon} \quad (\text{regulated mark-up})$$

The effect of regulation in this world is to reduce α below $1/(\epsilon-1)$, and to change Q in the way shown in figure 1 below, where QQ' represents the output of an unconstrained profit maximizing monopoly firm and QRR' represents the output of that same firm subject to the type of regulation obtained here. Notice that w can fluctuate between w_1 and w_2 without engendering any response by the firm (this is similar to the "kinked-demand" model) in terms of a change from the prevailing price and output situation (P_0, Q_0) .

In this context, an important question which must be dealt with involves the incentive effects of this characterization of the regulatory process compared with the more conventional A-J type model. The major characteristic of this process that is relevant is the ability of firms to retain increased profits from efficient operations of cost reducing technological change as long as no price rises are required.

-19a-

Figure #1



Proposition 7: During periods of falling or constant nominal average costs firms have an incentive to produce efficiently since all profits may be kept as long as prices stay below the level established by the regulatory commission in the last formal rate of return review.

Proposition 8: During periods of rising average costs A-J type biases may begin to become important.

Any improvement in production efficiency, either through efficient use of the prevailing technology, or through technical change can be kept by the regulated firm since reductions in production cost and rising rates of return are not "pounced" on as long as prices are not increased. This statement must be tempered for the situation of rising average costs. If more efficient production or some technological improvement can actually move a firm from a path of rising nominal costs to one of falling nominal costs, then the firm will have strong profit incentives to adopt it since it can now extricate itself from the formal hearing process and proceed to have r^* rise above s as average costs fall. Unless the direction of the cost path can be changed, however, the continuous interaction of firms and regulators in formal regulatory hearings, resulting from the necessity to raise output prices, is exactly the situation for which the A-J type model (with some modifications) would hold. I would therefore expect that it is under this situation of continuously rising output prices, triggering rate of return reviews that the A-J type models and the associated results are most useful.

This last result must itself be tempered by the realities of the review process itself. Regulatory commissions are not required to include every element of capital used by the firm in the rate base that is used for rate-making purposes nor to allow all "test year" expenses when calculating operating costs. The firm's incentive to produce inefficiently in the A-J

model is based on the assumption that all capital used in production will naturally be included in the rate base during a regulatory review. But regulatory agencies need not be so stupid. As pointed out previously, the rate of return is only one of many regulatory instruments open to regulators. Another is the power to determine exactly which elements of a firm's capital stock can be included in the rate base for ratemaking purposes. Actual inefficiencies that arise from the formal review process depend crucially on how careful the commission is in reviewing the "allowability" of the firm's expenditures and other elements of the formal hearing process itself.

The implications of this structural model of the public utility regulatory process will be discussed further below. It should be noted, however, that regulatory commissions staffed, funded, and whose administrative procedures evolved during periods when most firms were experiencing declining average costs, might be hard pressed to cope with the increasing number of formal rate of return cases that must be handled each year when average costs begin to rise for most firms. Both to cope with the administrative burden and to remove itself from the "limelight" position of "approver of price increases," structural changes in the regulatory process itself might be expected.¹⁷

¹⁷ This phenomenon on "regulatory avoidance" has also been demonstrated by the FPC with regard to its responsibility vis à vis the regulation of the field price of natural gas. Under the Natural Gas Act of 1938, it appeared to some that the FPC had the authority and responsibility to regulate the field prices of natural gas sold to pipelines for interstate transmission.

Empirical Evidence

Empirical evidence supporting or contradicting the propositions concerning the regulatory process advanced here is not voluminous. This

section presents the empirical evidence that I have been able to obtain, related primarily to the state regulation of electric utilities, and argues that it lends support to the picture of regulation that has been presented here. The evidence is certainly not definitive, but does suggest that more formal modelling of some of the structural relationships presented and further data collection is warranted. The first piece of evidence that is presented (Table 1) is the number of general rate of return reviews of private gas, electric and combination companies processed by state regulatory agencies in the U.S. between 1949 and 1972. Notice how much variability there has been in formal regulatory activity.

For electric utilities there are two periods of rather substantial regulatory activity (1949-1952 and 1969-present) and one period of more moderate regulatory activity (1957-1960). The remaining years - especially the period 1962-1968 show little formal regulatory hearing activity. The period 1949-1952 was a period of fairly rapid increase in the general price level. The period 1969-1972 was also a period of rapid inflation combined with an apparent exhaustion of scale economies to electric utilities. The period 1957-1961 saw rapid rises in the price of fuel inputs (especially natural gas) to the electric utility sector. The gas utilities have two periods of extensive regulatory activity (1957-1962 and 1968-present). The first period is associated with the rapidly rising field price of natural gas and the second period with the rising field price of natural gas and a general inflation in the economy. These figures may surprise some because of the dearth of regulatory activity during certain periods of time, especially when we recognize that the population of firms which could be under detailed review amounts to several hundred. The fact is, however, that during most of the 1960's there was very little formal rate of return review activity.

Table 1

Formal Rate of Return Reviews Processed by State Regulatory

Commissions 1949-1972¹⁸

<u>Year</u>	<u>Electric Utilities</u>	<u>Gas Utilities</u>
1949	15	12
1950	7	3
1951	25	3
1952	28	6
1953	19	6
1954	13	11
1955	8	0
1956	6	1
1957	11	8
1958	16	24
1959	19	22
1960	16	30
1961	12	24
1962	6	18
1963	3	12
1964	4	4
1965	2	8
1966	5	3
1967	3	7
1968	5	13
1969	16	20
1970	31	26
1971	40	42
1972	53	32

¹⁸ These cases are overwhelmingly reviews of general price increase requests by the regulated firms. Only two instances of regulatory review to force price decreases were found.

Detailed microeconomic data on gas utilities is difficult to obtain. As a result, the rest of the evidence presented deals with a sample of 133 large privately owned electric utilities subject to price regulation in one or more states.

Table 2

Rate of Return Reviews of Electric Utility Companies in Sample 1958-1972

<u>Year</u>	<u>Number</u>	<u>Year</u>	<u>Number</u>
1958	9	1966	3
1959	9	1967	1
1960	13	1968	4
1961	7	1969	15
1962	3	1970	24
1963	4	1971	30
1964	2	1972	48
1965	1	Total	174 formal rate of return reviews

The pattern of rate of return reviews for the 133 company sample is similar to that for the electric utility sector as a whole. Over 58 per cent of the regulatory reviews occurring between 1958 and 1972 took place during the final three years of the period. There was almost no regulatory activity for the nine year period 1961-1968. During the period 1958-1972, most companies had rather limited contact with the formal regulatory mechanism. As Table 3 indicates, over half of the companies in the sample were engaged in one or fewer regulatory reviews during the period in question.

If we examine the electric utility industry's operating expenses for the period 1946-1972 we find the proposition that cost increases trigger rate of return reviews, through attempts to increase prices, to be fairly

Table 3

Regulatory Hearing Engaged in By Particular Companies

1958-1972

<u>Number of Formal Rate of Return Reviews</u>	<u>Number of Companies</u>
0	44
1	41
2	34
3	8
4	4
5	1

(plus 18 cases in secondary states)

consistent with the data. Table 4 reports Electric Utility Operating Expenses for this period. Notice that rising expenses after WW II coincide with increased regulatory activity in the initial peak period (See Tables 4 and 1). A short period of rising costs from 1956-1958 coincides with a moderate amount of regulatory activity in the period 1957-1960. Falling expenses from 1968-1968 coincide with the period of almost no regulatory activity and rapidly increasing expenses from 1968-1971 coincide with the period of most extensive regulatory activity.

This kind of "cycle" in regulatory activity is consistent with the structural model of the regulatory process which views regulators as being passive, waiting for rate of return reviews to be initiated by firms as they attempt to raise their prices in response to increasing costs. This time series of regulatory activity does not seem to be consistent with the A-J view of the regulatory process. The A-J model (even those allowing for regulatory lag) might be consistent with a plethora of regulatory activity during periods of constant costs, but there is absolutely nothing in the A-J view which would predict an asymmetry between periods of increasing and

Table 4

Electric Utility Operating Expenses Per KWH (mills per KWH) (current \$)

<u>Year</u>	<u>mills per KWH</u>	<u>Year</u>	<u>mills per KWH</u>
1971	13.84	1957	15.35
1970	12.89	1956	15.17
1969	12.57	1955	15.37
1968	12.50	1954	16.05
1967	12.55	1953	16.00
1966	12.54	1952	16.22
1965	12.76	1951	16.22
1964	13.42	1950	16.29
1963	14.73	1949	16.79
1962	14.99	1948	16.69
1961	15.27	1947	15.87
1960	15.25	1946	15.51
1959	15.31		
1958	15.38		

decreasing nominal costs of production. If anything, the nature of the Kuhn-Tucker formulation might indicate that regulatory agencies would be more active as production costs fall and the rate of return creeps above the "allowed" level, than if production costs rise and the rate of return falls below that level. (Remember that the rate of return is constrained to be less than or equal to some allowed level.) The only way that the A-J model can be "saved" is to assume that the allowed rate of return changes over time, increasing during periods of falling production costs, and decreasing during periods of rising production costs. This type of extension quickly becomes tautological and only serves to hide structural components of the regulatory process which are useful for understanding how it changes over time.

The evidence presented so far therefore supports the conceptual model of public utility price regulation that has been put forward and appears to contradict the conception of regulation on which the A-J model is based. Let us concentrate at the period beginning 1961 and examine some of the other propositions that have been suggested. Production costs for electric utilities fall rapidly from 1961-1966, are then approximately level from 1966-1969 and begin rising rapidly in 1969.

Proposition 2 indicates that we should observe falling prices for electricity during the period 1961-1966 (despite very few regulatory reviews), stable prices from 1967-1969 and a rise in prices beginning in 1969 or 1970. The data in Table 5 giving average revenue per KWH of electricity sold by private utilities in the United States is almost completely consistent with the expectations of the theory. Notice especially that prices fell (1961-1966) despite the fact that there were almost no formal rate of return reviews during this period of time.

Table 5

Average Revenue Per KWH Sold

(Total Ultimate Customers)

cents per KWH

1961	1.69
1962	1.68
1963	1.65
1964	1.62
1965	1.59
1966	1.56
1967	1.56
1968	1.55
1969	1.54
1970	1.59
1971	1.69
1972	1.77

The price behavior becomes even more significant when we also look at earned rates of return for the 133 electric utilities in our sample. Propositions 3 and 6 indicate that we should observe increasing real rates of return and falling or constant prices during the period 1961-1966, stable and then falling rates of return beginning in 1967, and finally a new stability level (s) as more and more firms enter the formal hearing process to get their prices raised.

We look first at the average earned rate of return on original cost rate base for the 133 firm sample of electric utilities for the years 1961-1971. We expect that during the period 1961-1966 rates of return should be increasing even though prices have been falling. They should then begin to fall as cost increases are absorbed given stable prices, until they stabilize in 1970 as extensive rate of return review is initiated by firms whose earned rates of return have fallen to the level that they can expect to be allowed in a formal rate case.

Table 6

Average Earned Rate of Return on Original Cost
Rate Base for 133 Electric Utilities

<u>Year</u>	<u>RoR</u>
1961	7.03
1962	7.16
1963	7.32
1964	7.34
1965	7.46
1966	7.68
1967	7.57
1968	7.43
1969	7.33
1970	7.43
1971	7.42

As expected, the period of falling costs, falling prices and little regulatory activity (1961-1966) was also a period of rising rates of return. This kind of behavior is extremely difficult to square with the conception of regulation implicit in A-J type models.

An examination of the experience of the individual companies in the sample is also revealing. We expect that the vast majority of companies should have experienced increases in their earned rates of return during the falling cost (and price) period and decreases in their earned rates of return during "pre-regulatory review period" (1966-1969) as costs were rising, but rates of return were still too high to justify price increases through formal regulatory review. The experience of the individual companies in terms of changes in earned rates of return is reported in table 7 below.

Table 7

Changes in Rate of Return on Original Cost Rate Base for Individual Companies

	<u>Increase</u>	<u>Decrease</u>	<u>Total*</u>
1961-1966	110	20	130
1966-1969	53	75	128

* Data were not available on all firms in the sample for every year.

The vast majority of the companies in the sample (85%) showed an increase in their earned rate of return during the period of cost decline and minimum regulatory activity. During the second period of time when costs stopped declining, then increased, but just prior to substantially increased regulatory review, a majority of the companies (58%) showed a decline in their earned rates of return. This is especially significant when we recall that the nominal cost of capital increased substantially over this period of time. Table 8 gives an indication of the increasing cost of money in the context of the public utility bond yields.

Table 8

Public Utility Bond Yields

1960-1971

<u>Year</u>	<u>Yield</u>
1960	4.69
1961	4.57
1962	4.51
1963	4.41
1964	4.53
1965	4.60
1966	5.36
1967	5.81
1968	6.49
1969	7.49
1970	8.69
1971	8.13
1972	7.74

More evidence in support of the model of the regulatory process presented here may be obtained by examining the earned rates of return of those firms that have allowed themselves to become involved in formal rate of return reviews and those firms that have been able to steer clear of them. Proposition 4 suggests that rates of return of firms not engaged in the formal hearing process should be higher than the rates of return of firms engaged in formal regulatory review. Table 9 presents evidence on earned rates of return for those firms before regulatory agencies to have price increase requests and those firms that were not.

Table 9

Average Earned Rates of Return on Original Cost Rate Base for Companies
Subject to Formal Regulatory Review and Otherwise

<u>Year</u>	<u>Total Sample</u>	<u>Companies Having Review Within Past 3 Years</u>	<u>Other Companies</u>
1961	7.03	6.25	7.25
1962	7.16	6.58	7.29
1963	7.32	6.35	7.53
1964	7.34	7.08	7.40
1965	7.46	6.92	7.50
1966	7.68	7.19	7.71
1967	7.57	7.13	7.59
1968	7.43	7.20	7.44
1969	7.33	7.37	6.89
1970	7.43	7.20	7.50
1971	7.42	7.29	7.51

Notice in table 9 that the earned rates of return for the companies that did not engage in the formal hearing process saw their rates of return grow from 1961 through 1966, the period coinciding with falling production costs and very few rate reviews. (The yield on public utility debt was approximately constant during the first five years of this period and only began to rise during the final year of the period.) From a peak in 1966, earned rates of return fall until 1970 when they level out at about 7.5. In all years except 1969, the rate of return of firms engaged in the formal hearing process was below that for firms which were not engaged. The firms not engaged had no incentive to trigger a rate hearing, because they could look around them and see that they would be made worse off. The year 1969 is important, however. This year represents in some sense the "switchpoint" for the industry. It is in this year that many firms began to line up with rate of return requests as their profitability level fell toward s. The

fact that earned rates of return are lower for those that have not yet engaged in the formal review process than for those that are is indicative of the processing lag that exists and represents the generally poor profit performance of firms that have not yet been allowed to adjust their prices upward. Many of these cases had been processed by 1970, so that many of the firms that had been waiting to have their prices raised have dropped out of the "no regulatory review" sample and are in the "formal review" sample. As a result, the rate of return for the "no review" group falls slightly (more on this later). In effect we see that the "regulatory constraint" is applied only to firms seeking to have their prices raised. Rates of return of firms whose prices remain constant or decline are not subject to rate of return regulation. This basic asymmetry in the application of the rate of return constraint is certainly not incorporated in A-J type models. At the same time it should have important implications for the behavior of both regulated firms and regulatory agencies operating in different types of economic environments.

That's about all the evidence that has been pulled together to date to support which I believe is a more realistic "appreciative" model of the process of public utility price regulation during the post WW II period. One important conclusion of this model is that rapid and continual inflation in input prices, not counteracted by scale economies or technical change will inevitably trigger a large number of formal rate of return reviews. Moreover, as long as these dynamic cost conditions continue, firms forced into the formal rate of return hearings to raise their prices will find themselves continually forced to return to the formal hearing process, year after year, to have their prices reviewed once again. This causes serious problems for both the regulators and the regulated. In the next section

we examine in more detail why this result emerges, exactly what the problems are, and why increasing costs will trigger a search for new regulatory techniques.

Continuous Inflation and the Breakdown of a Regulatory Technology

The regulatory process that evolved for setting public utility rates in the post-war United States tended to minimize formal legal involvement, between firms and their regulators, in lengthy regulatory proceedings. The organizational process that evolved was predicated on the general cost characteristics of the industries being regulated. Electric utilities, experiencing substantial scale economies and technological improvement through much of the 1950's and 1960's, coupled with only moderate increases in the prices of inputs, were able to maintain or reduce nominal average production costs. Firms could thus maintain or decrease prices for output while achieving increased profits without resorting to price increases. As long as prices were not going up, regulatory commissions were happy to "live and let live," engaging in little or no formal rate of return regulation.

The situation with regard to retail gas utilities was not as fortuitous. Such companies may have experienced some economies of scale, but technological improvement was severely limited. In addition, retail gas utility costs had as their most important component, the price of purchased gas. To alleviate the need to institute formal regulatory reviews as wholesale gas prices increased, most regulatory agencies became very interested in "purchased gas adjustment clauses" which would "flow-through" wholesale price increases for gas directly to customers, thus bypassing the regulatory process entirely. In addition, many state utility commissions were active intervenors before the FPC in major gas price increase cases and were especially active in the Area Rate Proceedings initiated in the early 1960's.¹⁹

¹⁹The area rate adopted by the FPC itself appears to have been an attempt to eliminate the tremendous backlog of individual review requests that built up when the FPC began regulating individual gas field price contracts. See Phillips Petroleum Company v. Wisconsin 347 U.S. 672 (1954) and Permian Basin Rate Area Cases 390 U.S. 747 (1968).

Such automatic adjustment mechanisms worked fairly well as a mechanism for minimizing the necessity for formal rate of return reviews as long as the only input price that was rising was that of fuel.

In short, the regulatory process that existed by the late 1960's embodied regulators' desires to minimize lengthy formal regulatory reviews and the demand and production characteristics of the industries subject to regulatory authority.

The inflation and rising nominal interest rates in the late 1960's and early 1970's wreaked havoc on this process that appeared to function so smoothly before. Firms found that their nominal production costs were rising rapidly, as were their debt costs. Real and nominal rates of return began to decline, interest coverage plummeted and most major firms found that they had to raise prices (some for the first time in 25 years) and trigger formal regulatory reviews. State commissions that were "geared-up" to handle perhaps one or two major rate of return cases per year (many states handled one or two in five years) now found themselves faced with almost all the major companies in their jurisdictions requesting major price increases. Many state commissions had neither the staff nor administrative resources to deal with this tremendous increase in rate of return cases.

The coincidence of the large increase in rate of return reviews with increasing environmental concern, more vocal consumer advocates, and energy shortages compounded the problems. (We will return to these latter phenomena below.) By 1971, many state commissions found themselves extremely

overburdened with pending rate of return cases. As a result of the changing economic and social environment in which they were operating, the "satisfactory" balancing of different interest groups that had characterized the procedural equilibrium of the 1950's and 1960's was now being quickly destroyed. Regulatory agencies began to receive stronger and stronger "signals" from the external environment in the form of pressure and criticism. Regulated firms were complaining that their net earnings were continuing to disappear as they awaited rate relief - some of them found that their interest coverage had slipped so low that they were forbidden by the clauses in their bond indentures from floating more bonds. Simultaneously, demand was increasing rapidly and capacity shortages were emerging. Consumer groups and politicians were opposed to any price increases²⁰ and

²⁰This may imply money illusion, but I think more simply it reflects a general dislike for rising prices. Herbert Stein may tell people that they have never had it so good, but many laymen somehow believe that they may be able to stop all prices from rising, except their own wages, with appropriate action.

claimed their rights as intervenors to be heard in regulatory proceedings. Environmentalists criticized the regulatory agencies for establishing price structures that encouraged inefficient demand growth, laxness in the evaluation of generating and transmission site alternatives and general incompetence. They too entered as intervenors complicating regulatory hearings even more.

To compound the problems even further, regulatory agencies found that once they had processed a rate of return case and established new prices for the firm, a new price increase request was filed almost immediately, returning "processed" firms to the "queue" for new rate of return

reviews. Regulatory commissions soon discovered that firms never seemed to achieve the rates of return that they had been allowed in the hearings and returned immediately to seek a further price adjustment. They learned that under prevailing administrative procedures the increased number of price increase requests and rate of return reviews that they triggered was not a one shot adjustment in rate levels, but rather a continuing process of almost continual rate of return review. Rapid inflation had quickly changed a very passive and inactive "rate of return" regulatory process into a very active and continual process of administrative rate of return review. The regulatory process, in terms of both its techniques for approving rate adjustments and the staff inputs available to implement the techniques was completely unsuited for the new economic environment. It would not be unfair to say that state regulatory processes were close to breaking down by the end of 1971. Regulatory commissions found themselves in an extremely uncomfortable position caused by the interaction of the existing regulatory structure and changing economic and social conditions with which it had to deal.

Environmental Concern and Energy Shortages Compound the Problems

Rapidly increasing nominal production costs and rising nominal interest rates would probably have been enough to bring the rate of return regulatory process to a grinding halt and point of crisis.. There were other changes taking place, however. By the late 1960's and early 1970's the environmental movement had attained both a large following and substantial resources to take legal action against groups which caused environmental damage. One prime target became the electric utility industry. The electric utility industry was growing rapidly; pollution from fossil fuel generators, land

use problems associated with both generators and transmission lines, and increasing concern about the safety of nuclear generators made electric utilities a natural target. The existence of a ready made forum (regulatory commissions) to hear environmentalists' charges, combined with the fact that most companies were engaged in formal hearings to get their prices raised, made electric utilities an even more attractive target. By 1970 environmental groups began to enter regulatory proceedings as intervenors, presenting cases of increasing complexity. They represented a new interest group which generated signals that existing regulatory institutions were neither meant to nor capable of dealing with.

Responses to the Problems of Inflation and Environmental Concern

In the "behavioral theory of the firm literature"²¹ we are led to

²¹See generally Simon [23], Cyert and March [8], and Nelson and Winter [19].

believe that firms operating in stable and insulated environments will evolve "rules of thumb" or standard operating procedures for various decision situations. This appears to be the case with regard to regulatory agencies, both in terms of their interactions with the firms that they regulate as well as the regulatory techniques that they employ in the formal rate of return review process. The advent of rapid inflation, environmental concern and the resulting increase in the number and complexity of regulatory proceedings put the regulatory process under great stress and upset the existing balance between the external environment and the objectives of the regulatory agencies. Rules of thumb and standard operating procedures that had functioned fairly well under different conditions were now not leading to results satisfactory to almost any of the participants in the

regulatory process. The search for new regulatory procedures was on. We examine the inflation problem first.

The major effort was first aimed at implementing techniques that would quickly pass through higher production costs as higher output prices without the necessity of almost continual regulatory review and therefore eliminate problems associated with backlogs resulting from the long line of companies requesting price increases. The regulatory commissions wanted to eliminate the backlog problem and help companies that were experiencing severe financial distress, but also wanted to extricate themselves from the limelight of public scrutiny and criticism as the "people" who were always allowing the utilities to raise their prices. In short, everyone was looking for changes which would create a review procedure that would yield output prices that would "be good" for several years and eliminate the necessity of constant return for regulatory hearings.

Three techniques have been extensively implemented to deal with these problems:

- 1: Temporary Rate Increases - Prior to 1970 most proposed rate increases would be suspended pending the outcome of a formal regulatory hearing (about a 12 month lag time). To give companies immediate rate relief many commissions began to allow rate increases to go through on a temporary basis pending the outcome of the hearings. This effectively gave the companies more revenue since most of the rate increase was usually approved and the companies were now able to charge the higher prices 12 months earlier. Excess revenue that might have been collected while the case was pending is normally returned to customers.
- 2: Automatic Adjustment Mechanisms - Virtually all gas and electric utilities now have "purchased gas adjustment" or "fuel cost adjustment" mechanisms as

part of their rate structures. Such mechanisms automatically flow through any changes in the prices of gas or fuels used for generation into final output prices without the necessity of a formal regulatory review.²²

²² Attempts have also been made to institute "tax-adjustment clauses" but so far no commission has been willing to go for them.

The existence of these automatic adjustment clauses in 1973 enabled most electric utilities to flow through the rapidly increased cost of residual fuel oil resulting from the Arab boycott and increased OPEC prices without the necessity of lengthy formal rate of return review. Without these clauses, many companies in the northeast would have been driven to the brink of bankruptcy, if standard review procedures had to be followed.

3: Future test year - Traditionally rates were based on test year data which may have been as much as two years old at the time that new rates were finally put into effect. This was not too much of a problem as long as cost conditions were fairly stable over time. Serious problems resulted when costs during the test year were substantially lower than actual production costs at the time that the rates went into effect. Use of historical costs is obviously problematic when cost conditions are changing rapidly over time. Yet regulatory commissions stuck tenaciously to legal precedents that dictated the use of incurred costs and known changes in arriving at final prices. In the last 18 months a few commissions have begun to cautiously use "projected" test year results, allowing companies to predict cost and demand conditions one or two years ahead and to base rates on the anticipated cost situation.²³ I expect that this technique

²³ New York State has cautiously gone to a "forward looking" test year in two recent cases, but has emphasized that they should not be taken as

precedent or a permanent change in regulatory procedure (See Re Rochester Gas and Electric 1972). The California Commission, the Illinois Commission and the Florida Commission have also used future test years in recent cases. In December 1972 the FPC in Docket No. 7-463 initiated a proposed rule-making to base rates on a future test period.

will be imitated by many other regulatory commissions in the near future.

The changing nature of electric utility costs over time has already led to many changes in the process of public utility price regulation in the United States. Many of the responses made so far have been in some sense "obvious" from the viewpoint of an outsider, but often struck at the heart of long accepted administrative principles viewed from "inside." While in the case of inflation induced problems, the objectives of both regulated and regulators were generally coincident, the advent of the environmentalists represented the introduction of a new and vocal protagonist which viewed existing objectives and procedures of both the firms and their regulators as being in conflict with environmental preservation.

Environmentalists took two approaches in their attack on electric utilities. The first was to challenge siting and operating licences for generating and transmission facilities. This activity was and is going on in state, local and federal regulatory and court jurisdictions since such decisions need approval at many levels. The initial impact of such activities was to cause substantial delay in the approval process and was on the verge of causing severe supply shortages until Congress stepped into the picture in 1971.²⁴ Some states have sought to rationalize the

²⁴ Congress added section 192 to the Atomic Energy Act to enable the AEC to issue temporary operating licences through 1972 and the summer of 1973. Congress passed this act because of fear of peak period blackouts resulting from an inability of the AEC to process operating licenses quickly to conform with federal court interpretations of NEPA. See Calvert Cliffs

Coordinating Comm. v. AEC 449 F 2d 1109 (1971) and Izaak Walton League of America v. Schlesinger, 337 F. Supp. 33(D.C.D.C. (1971)).

siting questions by centralizing decisions in one or a few state bodies.

Few states have come up with a clear set of criteria to be used in arriving at decisions regarding siting and other land use and pollution problems.

Through careful use of the National Environmental Policy Act (NEPA) environmental groups have been successful in forcing responsible agencies to consider the environmental impacts of their decisions and sometimes establishing detailed criteria to be used for evaluation. Some of these evaluation procedures may not, however, be as meaningful as they appear on the surface.²⁵

²⁵See Joskow [15].

Of more interest to us here is the direct action of environmental groups in state utility commissions to challenge the structure of public utility rates. Until this time, most state commissions did very little actual regulation of the structure of rates, being primarily concerned with the total profits resulting from a particular rate structure at the time a firm was in for a formal regulatory review. Environmental intervenors argue that regulatory commissions have a statutory responsibility to carefully regulate the structure of utility rates as well as to determine a fair rate of return. They have argued in particular that the proper criterion for a price charged to a particular group should be the marginal social cost of producing output. They have challenged the firms and the regulators to justify all rate structures based on such cost criteria.

The particular target has been the declining block nature of electric

utility rate structures.²⁶ Environmentalists have argued that such rate

²⁶By declining block rate we mean that as consumption increases, the cost of an additional KWH of energy declines.

structures encourage the uneconomic expansion of consumption, leading to unnecessary capacity expansion and the overconsumption of electricity. They have suggested so called "inverted rates" as an alternative price structure that would be more efficient.²⁷ The important thing to realize

²⁷I have discussed many of the issues associated with the rate structure controversy elsewhere. See Joskow [14].

for the discussion presented here is that regulatory commissions were now being asked to take on an additional responsibility, which they always had, but which they rarely acted upon in any scientific way. Most commissions hadn't the slightest idea of how to come to grips with these issues - some of them were even shocked to find out that prices and consumption had anything to do with one another.

The initial reaction to this new set of external signals was not surprising. Both the regulatory agencies and the regulated firms attempted to resist suggested changes and hoped to eliminate the whole rate structure question, restoring the status quo ante. This reaction appears to have been more of a "gut" reaction of entrenched bureaucratic elements in the regulatory agencies and the regulated firms. Procedures which had been followed for over twenty years would not be quickly abandoned. The forces within the companies that opposed change tended to be the people who had previously been responsible for establishing rate structures. They were primarily accountants who had evolved some mysterious mechanism for

establishing rates. The concept of marginal cost was extremely difficult for them to understand. They were now being called on to explain and justify the methodology that they used for establishing rates and any meaningful methodology often appeared to be lacking - new rates were often across the board percentage markups of the existing rate structures. They both resisted revealing the technique that was being used and were uncooperative in trying to implement a new technique. Accountants for the staffs of the commissions were faced with exactly the same problems and appeared to be resistant to change for exactly the same reasons.²⁸

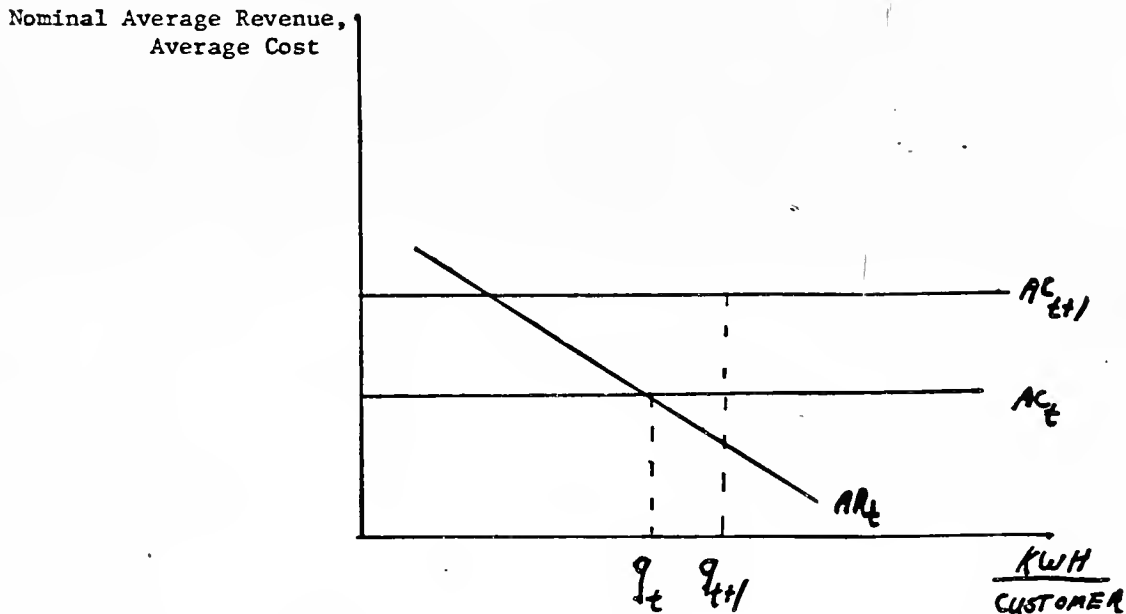
²⁸ Economists often view organizations as rational unitary decisionmaking units. However, many of the problems associated with changing regulatory procedures arise from internal conflicts within the organizations concerned themselves. For a discussion by a political scientist concerning the implications of viewing decisionmaking organizations through alternative conceptual models (rational, bureaucratic and organizational) see Allison [1]. Perhaps economists who are students of regulatory agencies can gain some insights by expanding the set of conceptual models that they utilize.

More careful reflection on the part of people higher up in the companies and on the commissions' staffs however soon resulted in an important realization. Electricity consumption per customer had been growing over time. As a result, given a particular rate level with declining block rates, average revenue per KWH was declining over time. At the same time average nominal cost was rising over time even though output was increasing (i.e. economies of scale and technological change were not offsetting increases in input prices any more), since at the time of a regulatory hearing average costs were set equal to average revenues, average revenue would be below average nominal cost in the following period with or without growing demand, but the declining block character of electric utility rates exacerbated the situation. This situation is depicted in figure 2. At

time t average nominal cost and average revenue are equal at output q_t . At time $t+1$ (where output has expanded to q_{t+1}) average revenue is less than average cost and to restore equality a new regulatory hearing must be instituted to shift the rate structure upward.²⁹

²⁹ AC_t represents the static average cost function at period t . q_t represents output at period t and AR_t represents the rate structure established to take effect in period t and continue to be in effect during period $t+1$. Demand is assumed to grow autonomously over time and the average cost function shifts upward over time as input costs rise. These problems are discussed in more detail in Joskow [14].

Figure #2



Those concerned with eliminating the bottlenecks in the regulatory process caused by inflation and environmental intervenors have begun to see a solution to their problems. Inverted rates might not make sense in terms of static efficiency criteria, but might not they be a clever way of eliminating the revenue erosion problem and forestalling the necessity

of firms returning to the regulatory commission year after year? Why not have inverted rates as in figure 3 as a way of coping with the dynamic "problems" associated with the frictions of the regulatory process.

Inverted rates or at least "flattened" rate structures now may begin to look good to both the firms and the regulators who want to deal with the environmentalists, forestall continual return for formal rate of return reviews and restore a satisfactory regulatory equilibrium. Once the possibilities are recognized, these actors may realize that an even steeper rate structure, as in figure 4, might even be better in this regard. Now as output per customer grows (over time) average revenue could increase even faster than average cost.³⁰ Since this would be accomplished without the necessity of filing new rates, the firms would no doubt be able to keep

³⁰We have ignored "real price effects" on the demand for electricity.

Figure #3

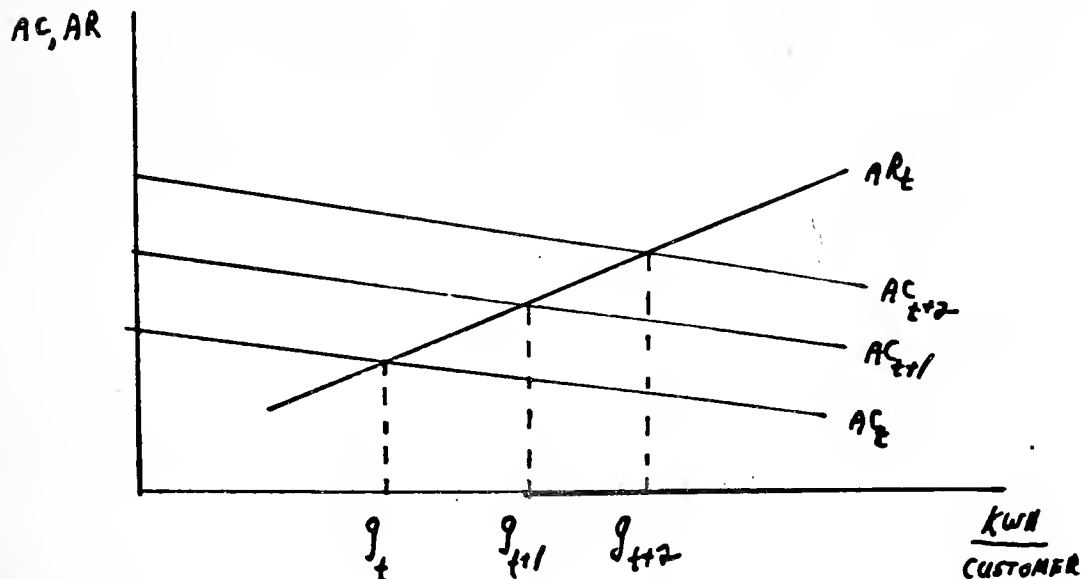


Figure #4

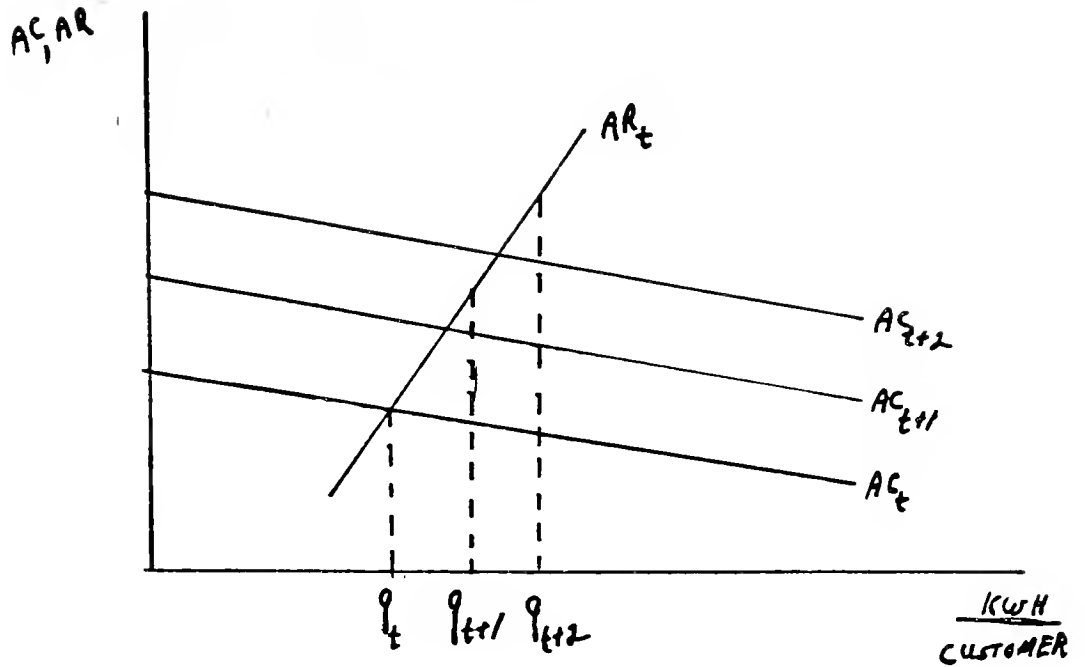
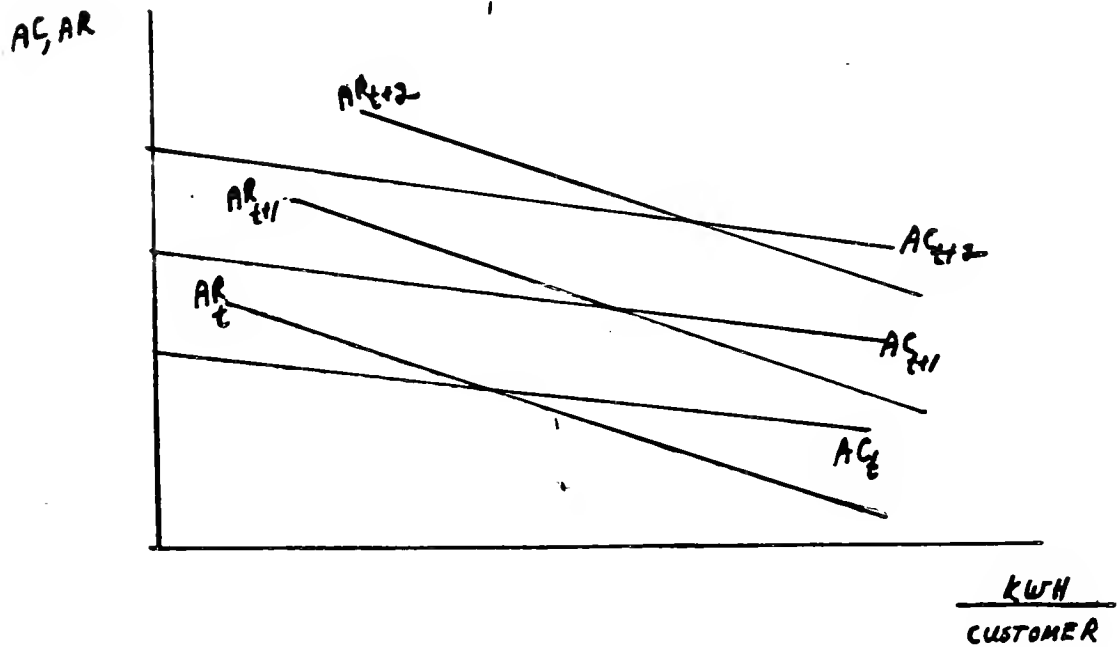


Figure #5



any excess revenues that were being achieved. While a solution as depicted in figure 5 would probably be ideal on economic efficiency grounds - where the static rate structure is shifted upward each period to reflect rising nominal costs and the static rate structure itself is based on temporal marginal costs - both the firms and the regulators seem to be willing to consider inverting or flattening the rate structure to eliminate regulatory bottlenecks. This type of rate structure may be favored as a way of avoiding continuous formal regulation. Since the environmental intervenors believe that this was a way of dampening demand³² they seem to be very

³²How much such a rate structure really changes demand patterns depends heavily on the distribution of the population (in terms of average KWH consumption) over the rate structure.

satisfied with it.³³ Commissions have begun to show more and more willingness

³³Although very recently some have come to realize that inverted rates may do much more to increase the profits of regulated firms than to dampen demand growth. As a result there has been some shift from a request for "inverted rates" to a desire for a real system of peak load pricing.

to tackle the rate structure question (often over the objections of the accountants on their staffs and some economists) if they can then design rates which eliminate or forestall the revenue erosion problem and the necessity of continual regulatory review.

As a result of this apparent coincidence of objectives a number of states have moved to "flatten" out the rate structures of the electric utilities. I am afraid that this movement has been more a result of the effects of flatter rate structures on earnings erosion (as discussed above) than the result of a careful methodology based on marginal cost pricing

principles. Nevertheless, the major states (New York, California, Michigan and Wisconsin in particular) have begun to solicit and consider testimony calling for the establishment of a cost based methodology for the regulation of the structure of prices in addition to the traditional rate of return based methodology for establishing the overall profit level. It is expected that state regulatory commissions, at least in the "leading states" (more on this below) are on the verge of embarking down the rate structure regulation path with an emphasis on using rate structure manipulations to deal with dynamic problems within the regulatory process itself that results from continuous inflation, while at the same time appeasing environmentalists.

An example of how the shape of electric utility rate structures are being changed is provided below. The example is for the new rates established for the Consolidated Edison Company of New York in October, 1973. Notice how the residential and commercial rate structures have been simplified and the "tilt" reduced. The effect of this flattening of the rate structure should be that average revenue should decline more slowly over time as average consumption per customer increases. As a result, firms should find it necessary to return for rate relief less frequently than would be the case with rate structures having a greater tilt. Whether or not the new rate structures will have much of an effect on demand growth is, I believe, still an open question.

Residential and Religious Classification:

<u>Old Rates</u>		<u>New Rates</u>	
First 10 Kwh	\$2.01	First 10 Kwh	\$2.61
Next 50	4.765¢ per Kwh	Next 990	3.91¢ per Kwh
Next 60	4.265¢ per Kwh	Over 1000	3.49¢ per Kwh
Next 120	3.755¢ per Kwh		
Over 240	3.155¢ per Kwh		

Small General Service Classification: (Small Commercial)

<u>Old Rates</u>		<u>New Rates</u>	
First 10 Kwh	\$2.67	First 10 Kwh	\$4.00
Next 290 Kwh	6.006¢ per Kwh	Over 10	4.63¢ per Kwh
Next 600	4.895¢ per Kwh		
Next 1200	4.340¢ per Kwh		
Over 2100	4.062¢ per Kwh		

Change and Diffusion of Regulatory Techniques

We have viewed the basic desire of regulatory agencies as one of conflict minimization. They are constrained in satisfying this objective by the interests of other actors in the regulatory process. These interests are expressed in the form of signals from these actors directly or through intermediaries like the courts, the legislature, the press, etc. Consumers and public interest groups, politicians, etc. become active when nominal prices rise, service quality deteriorates or of late, when environmental damage is inflicted. Commissions therefore try to keep prices from rising, quality of service high, and to transfer environmental responsibility to other agencies. The companies actively try to raise their prices or reduce the quality of their service as costs increase and profitability declines. The commission attempts to satisfy these conflicting interests in a way that minimizes formal legal proceedings that are time consuming, expensive

and bring the regulators into public view. Regulators in the past have, by and large, tended to be fairly passive, seeking to avoid the limelight. We may view the regulatory process circa 1968 as being in such an "institutional equilibrium." The process of limited and infrequent formal regulation appears to have satisfied most participants fairly well. The changing economic, legal and social environment beginning in 1969 pushed the regulatory process into an institutional disequilibrium position. None of the participants seemed to be satisfied with the way the process was working. Changes in the structure of the regulatory process were called for.

Non-market organizations and government bureaucracies are not usually conceived of as possessing a technology, engaging in research and development activity, and adopting new techniques which were not previously known. It is convenient, however, to view the organizational structures, standard operating procedures, and legal rules observed in the various state regulatory agencies as defining a "regulatory technology." For example, there were three techniques for valuing the rate base of a utility: original costs, fair value, and reproduction cost. Together they compose the known technology for rate base determination. Similarly, the various ways in which regulatory commissions combine the rate of return determination with the rate base determination to arrive at a new set of prices defines another aspect of the regulatory technology. Since many states face the same types of regulatory problems, operate under similar general legal structures,³⁴

³⁴ Obviously all of the states are subject to rulings by the Supreme Court based on the Constitution.

and are faced with generally similar sets of constituents, it is not at all surprising that at a point of institutional equilibrium we observe most commissions using very similar techniques for administering their regulatory

responsibilities.

But to understand why the ultimate equilibrium position involves so much homogeneity we must investigate the process of change that occurs when the regulatory process is thrown into a disequilibrium position as appears to have happened recently.³⁵ Casual empiricism indicates that

³⁵ There is a small but interesting literature on the diffusion of governmental innovation among the states that has been generated by political scientists. See especially "The Diffusion of Innovation Among the American States" by Jack L. Walker, American Political Science Review, September, 1969 and "Innovation in the States: A Diffusion Study" by Virginia Gray, American Political Science Review, December, 1973. While the literature has been interesting and helpful, it suffers from several shortcomings. First it fails to specify a satisfactory theory of why a particular type of new government function or new way of performing an existing function is adopted in the first place at a particular point in time. Second, it fails to distinguish between new functions and new ways of performing old functions. Third, the diffusion "model" itself, much like behaviorial learning theory, is an almost entirely empirical construct with little ability to predict ex ante much more than an "S" shaped curve. These criticisms could, however, probably be weighed equally against economists' models of technological change and innovation. For an attempt to deal with some of these problems see Nelson and Winter [19].

there are a small number of state commissions that are "leaders" and a larger number that are "imitators." The leaders always appear to be the same (New York, Wisconsin and California). They appear to perceive the problem areas earlier and then begin to search for new techniques of organization or calculation which will return them to a position of equilibrium. This sequential search process characterizes "technological change" of the regulatory technology. We are in the process of observing such a search procedure now. The "leaders" try a slightly different way of making a calculation (future test year for example) or a new method of defining their relationship with the prices of the firm (automatic adjustment mechanisms). They try it for one or two firms, and see what the response is. Does the new technique ameliorate a problem which they have? Do any of

the participants in the regulatory process object strenuously to the use of these new techniques? Do state and federal courts find these techniques legal or illegal?³⁶ If the answers to these types of questions are generally

³⁶ This is another source of administrative delay. The initiation of a new regulatory technique may lead to extensive court litigation. This is exactly what happened when the Federal Power Commission instituted the Area Rate method. The natural gas producers challenged the legality of this methodology all the way to the Supreme Court and a final determination was not made until 1968.

favorable we will gradually see the new technique adopted as standard operating procedure. If it does not work out too well, it will be scrapped and the search process continued until a satisfactory set of new techniques are found.

The imitators are constantly monitoring the activities of the leaders during this disequilibrium situation. As the leaders adopt new techniques of regulation we will see the imitators adopting them also, usually citing the leading commissions as precedent for their decisions. The leading commissions also watch the behavior of other leading commissions, learn from their experience, and adopt successful techniques for which they have been unsuccessful in finding alternatives. During periods of disequilibrium and search we will observe many different techniques in use as leading firms search for and slowly adopt effective technologies with imitating firms following slowly behind. The new equilibrium position will involve a smaller number of effective regulatory techniques in use. The exact diversity of techniques among the population of commissions in equilibrium will depend upon differences in the economic and political environment in different states, the supply of satisfactory new techniques and whether we believe that utility commissions are maximizing some well defined preference function subject

to a set of constraints or merely satisficing, stopping their search when a satisfactory set of new regulatory techniques is found.

The Regulatory Process and A-J Type Models

Where does this leave us with regard to A-J type models of public utility price regulation? The essence of public utility price regulation is not the rate of return constraint. The rate of return aspect of regulation is merely a method by which a regulatory commission justifies its approval of price increases or major changes in rate structures. Without such triggering mechanisms the rate of return constraint is essentially inoperative. To understand public utility price regulation, how it affects prices, service quality and static and dynamic efficiency we must understand it as a dynamic process. Public utility price regulation has very different effects on firm decisions today than it did in the 1960's. Firms are much more cognizant of the formal regulatory review process because they find that inflation has forced them to continually interact in this more formal regulatory environment. But the dynamics of the regulatory process indicate that the current situation will not last for very long, since it does not satisfy the preferences of the major parties concerned. New techniques for minimizing formal regulatory contact are evolving. These techniques involve new standard operating procedures, automatic adjustment mechanisms, and new types of rate structures. The effects of these techniques are as yet unknown. I believe, however, that their major thrust will be to "unbind" the firms under regulation from any kind of formal rate of return constraint. Does it make sense to rest our theoretical understanding of the effects of public utility regulation on a constraint, which the process itself continually seeks to make inoperative? I believe that the answer is no. More fruitful efforts would be directed at understanding the actual techniques

of regulation that really influence firm behavior and understanding how the process itself and the techniques that are used change as the economic environment changes.

The view presented here captures many of the important elements of the process of price regulation by state and some federal regulatory agencies. Besides being more satisfying intellectually I believe that it can explain a great deal of evidence that has either been considered paradoxical or pointed to as major "failures" of public utility regulation. For example, a number of studies have pointed to the fact that during the 1960's electric utilities were earning returns substantially above their capital costs. The discussion presented here indicates first that this is not surprising, and second that this situation would not last if average production cost began to rise. The problem was not that commissions were establishing overgenerous "allowed rates of return," but that regulatory agencies didn't care about the rate of return unless prices were increased. Once price increase requests were filed, regulatory commissions were much more diligent at keeping the rates of return of "price increasing" companies much closer to the cost of capital. During the interim period, as costs were rising, but earned rates of return for many firms were higher than they could expect to be allowed in a formal hearing, prices did not go up as one might expect from a more naive model, but were absorbed by the regulated firms up to the point where it was worthwhile to sustain a rate of return review by filing a price increase request. During the "regulatory disequilibrium" position as firms were constantly in for regulatory review, price increases followed cost increases with a 12-18 month lag, with real rates of return remaining substantially below previous high levels. I would venture to predict that the structural changes now taking

place will result in production costs being passed along as higher prices more quickly and a rise in the real rates of return of many regulated firms.

Public utility price regulation is a complicated but understandable institutional phenomenon. The actual control mechanisms that are used to effect prices will, however, differ as the economic and political environment in which the participants operate changes. The kinds of techniques that will be used in different "regulatory equilibrium" positions are predictable and their effects understandable. The nature of a particular set of regulatory control mechanisms, why they change, and how they change, requires us to have a better understanding of the actual structure of regulation. We should seek to understand mechanisms which cause the process to be pushed out of equilibrium, what happens during a disequilibrium period, and how the process changes to restore a new regulatory equilibrium. A-J type models do not give us the framework to understand these phenomena because they do not provide the proper framework in which such questions might be naturally posed and perhaps answered.

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